Structural Steel: An Industry Overview

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The United States structural steel industry supplied fabricated and erected structural steel framing for over 10,000 buildings, bridges and industrial facilities through a network of producers, service centers, steel fabricators and erectors in 2017 down substantially from a peak of nearly 15,000 in 2006 and 2007. The decrease in market volume was the result of a downturn in overall construction activity. Total industry employment in 2017 was estimated to be in excess of 200,000 individuals in 2,300 rms down approximately 15% from 2006. Total industry revenue in 2017 was estimated to be in excess of 20 billion dollars. It is anticipated that industry employment and revenue will expand by four percent during 2018 based on the current 2018 growth rate of non-residential construction.

Structural Steel Supply Chain

The four distinct components of the structural steel industry are:

- Producers of structural steel products, including hot-rolled structural sections (wide- ange shapes, plate, channels and angles) and manufacturers of hollow structural sections (formerly known as tubular steel).
- Service Centers, which function as warehouses and provide limited preprocessing of structural material prior to fabrication.
- Structural Steel Fabricators, which physically prepare the structural steel for a building or a bridge through a process of developing detailed drawings (the work of a detailer) based upon the construction drawings provided by a structural engineer; material management; cutting; drilling; shop tting (bolting and welding); painting or galvanizing (when required); and shipping.
- Erectors, which assemble the structural steel members into a structural frame on or off the project site by bolting and eld welding structural steel components together according to the construction documents.

Producers

Four structural steel shape producers—Nucor-Yamato Steel/Nucor Berkeley, Gerdau, Steel Dynamics Inc. and Bayou Steel—account for over 95% of all hot rolled sections produced in the United States at six mill locations. Five producers, including the four mills mentioned above, supply the market with other hot-rolled shapes, such as angles and channels. All hot-rolled shapes are produced using electric-arc furnaces with ferrous scrap as the primary feed stock. The use of scrap results in an average recycled content greater than 93% for all hot-rolled structural material produced in the United States.

Hollow Structural Sections (HSS) for building applications are produced by a signi cant number of manufacturers including Atlas Tube and Nucor Tubular Products, who account for more than 75% of the HSS production for buildings in the U.S. HSS are manufactured from sheet steel that may be produced in either a basic oxygen furnace or an electric-arc furnace. The recycled content of these sections is 33% and 90%, respectively. The domestic market for HSS in 2017 was approximately 1.6 million tons.

Steel plate is used in the construction of both bridges and buildings and is produced domestically in both electric arc and basic oxygen furnaces. The weighted average based on production method for recycled content of plate used in construction applications is 75%. U.S. plate producers serving the construction market include Arcelor-Mittal, Nucor and SSAB. AISC estimates are that 700,000 tons of plate are used annually for construction projects in the United States.

Sustainability

Structural steel has long been considered the premier green construction material, and the structural steel industry continues to improve its leading environmentally friendly position by further reducing greenhouse gas emissions. While numerous legislative and regulatory efforts in recent years have targeted emissions, energy ef ciency, and related environmental concerns, the structural steel industry has been proactive in pursuing measures of its own that typically exceed regulatory requirements.

The results of structural steel industry efforts are evident in recent ndings on greenhouse gasses, which show that on a per ton basis the iron and steel industry reduced carbon emissions by 36% and energy intensity by 31% since 1990. By comparison, initiatives such as the Kyoto Protocol would have required U.S. industries to reduce emissions by 5.2% by 2012.

At the same time, the industry remains the world leader in the use of recycled material and end-of-life recycling, with the recycled content of the structural steel beams and columns produced at U.S. mills exceeding 93% and a recovery rate of 98%.

Production and Demand

Production of hot-rolled structural shapes in the United States in 2017 exceeded 6.1 million tons, of which 8% was exported. Approximately 4.4 million tons of this total represented wide-ange shapes. Imports of both mill and fabricated material have increased signi cantly over the past ve years. In 2017 21% of the structural steel used in the U.S. was sourced from overseas with 14% of the structural steel erected in the United States fabricated outside the U.S. This increase in imports from countries providing direct and indirect subsidies to their steel industries, has placed signi cant pressure nthe domestic structural steel producers and fabricators.

A recent update of a 2009 structural steel utilization survey, including HSS, indicated 40% of domestic consumption of structural steel is utiliz1.2ed U.S. i s0 -1.273 T273 Td for recors indIbt5of0 -1327

steel vary greatly based on the type of structure being constructed, the number of pieces, local labor conditions and the complexity of the connections. An AISC member fabricator in the area of the project (a list of member fabricators is available on the AISC website www.aisc.org) is the best source for fabrication costs for a specific project. The practice of minimizing the weight of the structural steel in a building is often short-sighted as lighter sections, while satisfying the strength requirements of the structure, may result in more costly connections and fabrication procedures.

Bridge Fabrication

Although the bridge industry follows a similar fabrication process, it differs in some key areas. If a bridge is selected to be funded, it becomes part of a state's long-term improvement project list. These long-term improvement projects are updated periodically to reflect current needs. Depending on the complexity of the project, it may require more extensive environmental review, public involvement and approval by the State Legislature and the Governor. Projects then enter the design phase where project plans, specifications and estimates packages are prepared. Many states have been forced to reduce engineering staff and are becoming more reliant on consultants for design services. However, states will choose to perform design in-house if possible. At this point the plans, specifications and estimates package are prepared for contractor bidding. A competitive bid letting process is often used for selecting fabricators. Construction may start within 30 to 45 days of the contract being awarded.

Owners are faced with reduced construction and maintenance budgets, and will look for ways to reduce the first time and overall life cycle cost of their bridge assets. Many owners today now see weathering steel as the first choice for corrosion protection and as a way of reducing fabrication, maintenance and overall life cycle

Erectors

Erectors are the most visible component of the structural steel supply chain, because they perform the actual construction work at the project site. Most building erection is performed under the same contract as the steel fabrication, with the fabricator either providing in-house erection services or sub-contracting the erection work to a quali ed rm. Field erection involves assembling the

Marketplace Demand for Structural Steel

Structural steel is the leading structural framing material for buildings in the United States, with a 46% market share for 2017 for non-residential and multi-story residential construction. The market share for the closest competing material—reinforced concrete—is only 34%, indicating a strong market preference for structural steel.

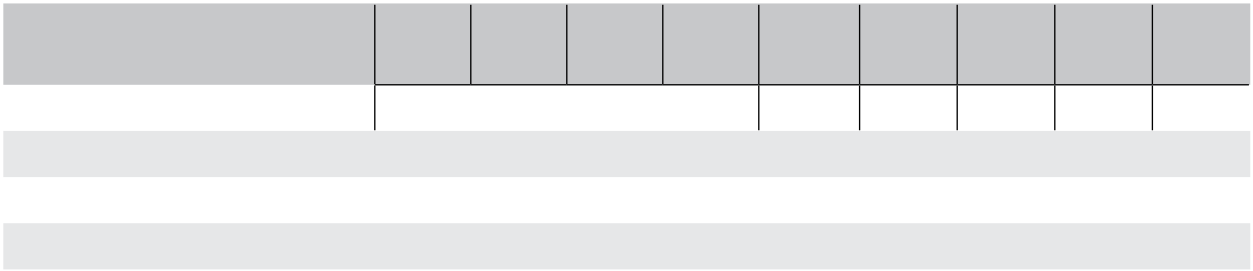
Market share values for all structural framing materials over the past nine years for non-residential and multi-story residential building construction based on square footage are as shown in the following table. The increasing proportion of residential construction since 2011 has resulted in an overall decrease in steel market share.

Non-residential construction represented 37% of the overall demand for structural steel with each point of market share being equivalent to 40,000 tons of structural steel. Multi-story residential construction accounted for 8% of the overall demand for structural steel with each point accounting for 500 tons of structural steel. Structural steel's multi-story residential market share, which includes hotels and dormitories, has grown signi cantly over the past ve years and is currently 37%.

The remaining demand for structural steel is comprised of two market segments:

- Non-building structures, which includes open-air stadiums, process and chemical plants, power plants, petroleum re neries, and other buildings that do not have a roof. Structural steel maintains a dominant share in these markets with these non-building structures generating approximately 40% of the demand for structural steel.
- Non-structural applications such as rack systems, marine applications, trailers, transportation and mobile homes comprise 15% of the overall demand for structural products.

Bridges are a special case in that the majority of bridge structures are fabricated from plate steel rather than hot-rolled shapes or HSS. Plate steel is not considered in the supply or demand calculations presented above. Hot-rolled shapes for bridges comprise 6% of the overall market for structural steel and are included in the non-building structures referenced above.



The dominant market share of structural steel demonstrates the continuing recognition of the advantages structural steel brings to building projects. :roadvantagesw4 (,advanal steel briengineer ,advanagene bri)]